New Naticidae (Gastropoda) from Brazil

Paulo Márcio Santos Costa
Museu Nacional, Universidade Federal do Rio de Janeiro
Departamento de Invertebrados
Setor de Malacologia
Rio de Janeiro, CEP 29940-040, BRAZIL
pmscosta@yahoo.com

Guido Pastorino
Museo Argentino de Ciencias Naturales
Av. Ángel Gallardo 470, 3° piso, lab. 80
C1405DJR Buenos Aires, ARGENTINA
gpastorino@macn.gov.ar

ABSTRACT

Two new species are described from Brazil. *Notocochlis laurae* new species from the Canopus Bank, a seamount located 160 Km off Fortaleza, Ceará, is characterized by its large size, the umbilical and parietal calluses separated by a notch, a straight sulcus, and a moderately developed funicle, brownish-white color, with axial and oblique bands extending from the suture to the lower third of the whorl, and the subsutural region with a thin white spiral band. *Notocochlis isabelleana*, a shallow water species, is comparable and can be differentiated from *N. laurae* by its small size, rounded shape, coloration pattern and operculum with only one marginal rib. *Notocochlis guesti*, a deep-water species that occurs in Bermuda and the Caribbean, can be differentiated by its rounded profile, pale coloration pattern, and radular characters. *Natica jnani* new species, distributed from southern Brazil to Uruguay, has a small, smooth shell, with an obsolete funicle. Its color pattern has axial brownish zig-zag, interconnected, flammules over a white background. The internal margin of the operculum is serrate and the external margin has two thick cords. It is similar to *N. perlineata* and *N. menkeana*, both Caribbean species with different coloration pattern and a thicker funicle in the latter.

Additional keywords: Natica, Notocochlis, Canopus Bank Seamount, *Notocochlis guesti, Natica menkeana, Natica castrensis*

INTRODUCTION

About 17 species of Naticidae are known from the Brazilian coast. Except for a few rare species (e.g., *Enspira radiata* (Watson, 1881), found below 500 m) most naticid species known from this region occur in shallow waters (Rios, 1994). Nevertheless, a systematic revision of the entire family from Brazilian waters is needed. One problem in studying this family is that some genera remain inadequately defined. Many of the species are easy to identify, but some of the subfamilies and genera require better phylogenetic resolution, as some are grades, not clades. Traditionally, the genus *Natica* sensu lato has been used as a catch-all name including the numerous species belonging to the subfamily Naticinae. Pastorino (2005) recently reviewed all the species of naticids living along the Argentine coast, restricting the use of *Natica*, and using the genus *Notocochlis* Powell, 1933 for several southwestern Atlantic species hitherto placed in *Natica*.

In 2005, during a dredging expedition on the northeastern coast of Brazil, mollusks were collected between 240 and 260 m depth from Canopus Bank, off Ceará, including a new species of Naticidae, which is described in the present paper.

MATERIALS AND METHODS

Several shells and live specimens were dredged from Canopus Bank, off Ceará, Brazil, by commercial fishing boats; others are from the stomachs of the fish *Ogcocephalus vespertilio* (Linnaeus, 1758) and of the starfish *Astropecten* sp. Additionally, material from the collections of the Museu Nacional do Rio de Janeiro (MNRJ), Museu Oceanográfico Professor Eliézer de Carvalho Rios (MORG), and Museo Nacional de Historia Natural y Antropología, Montevideo (MNHNM) (collected during several cruises of the B/I Aldebarán and the R/V Academik Knipovich), were also studied.

Radulae and jaws were prepared by as in Solem (1972). Scanning Electron Microscope (SEM) photographs were taken with a Philips XL30 at the Museo Argentino de Ciencias Naturales "Bernardino Rivadavia" (MACN) and a JEOL JMS – 6390 LV at the Centro de Microscopia Eletrônica de Varredura at the Museu Nacional/UFRJ.

SYSTEMATICS

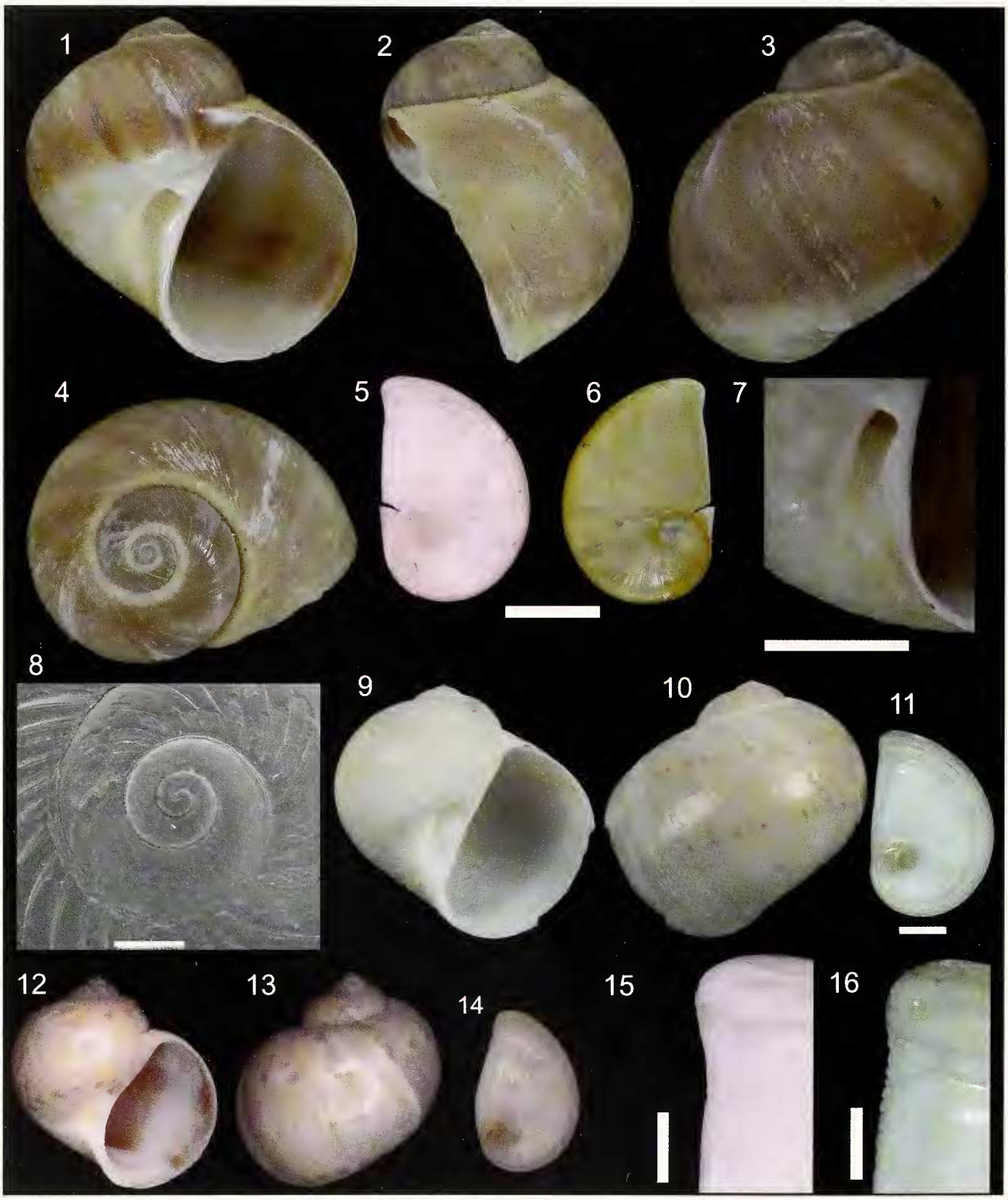
Superfamily Naticoidea Guilding, 1834
Family Naticidae Guilding, 1834
Subfamily Naticinae Guilding, 1834

Genus *Notocochlis* Powell, 1933

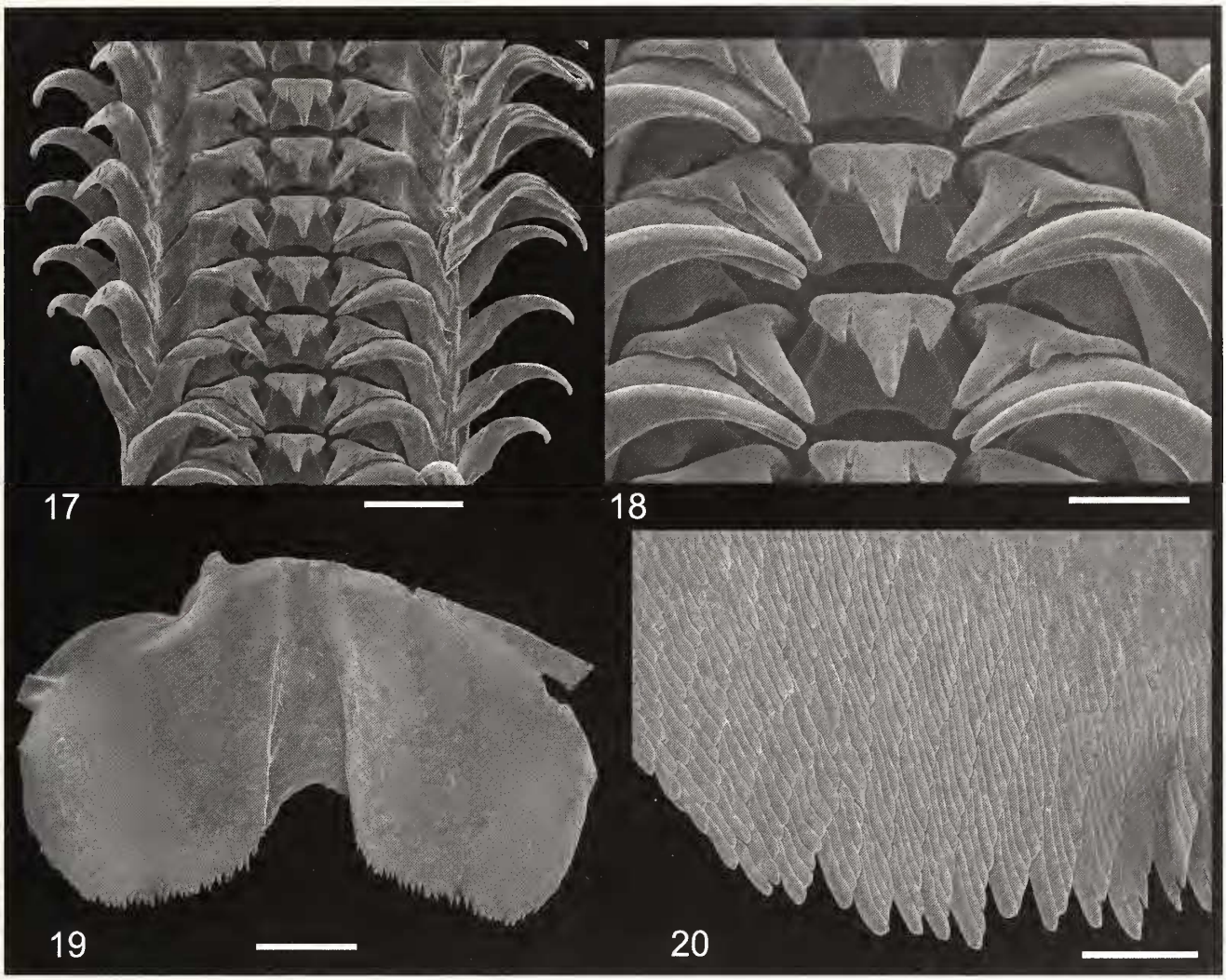
Type Species: *Cochlis migratoria* Powell, 1927, by original designation (=*N. gualteriana* Récluz, 1844).

Notocochlis laurae new species
(Figures 1–8, 15, 17–20)

Diagnosis: Shell of large size for genus, reaching about 40mm. Color brownish white, axial and oblique bands, from suture to lower third of whorl; white thin



Figures 1–16. Naticid species. **1–8, 15.** *Notocochlis laurae* new species. **1–7.** Holotype MNRJ 11866, 33.2 × 31.0 mm. **5.** External view of the operculum. **6.** Internal view of the operculum. **7.** Detail of the umbilical area. Scales bars = 1 cm. **8.** Paratype MNRJ 11867, SEM detail of the protoconch. Scale bar 500 µm. **15.** Detail of the operculum. Scale bar = 2.4 mm. **9–11, 16.** *Natica guesti* Harasewych and Jensen, 1984. **9–10.** Two views of the holotype, USNM 765087. **11.** External view of operculum. Scale bar = 1 cm. **12–14.** *Notocochlis isabelleana* MNRJ 17873, 19.5 × 18.8 mm. **12–13.** Views of shell. **14.** External view of the operculum. **16.** *Natica guesti* Harasewych and Jensen, 1984, detail of the operculum showing the smooth inner margin. Scale bar = 2.4 mm.



Figures 17–20. *Notocochlis laurae* new species. Holotype MNRJ 11866. **17.** Radulae. Scale bar = 100 μm. **18.** Detail of rachidian teeth. Scale bar = 50 μm. **19.** Jaws. Scale bar = 500 μm. **20.** Detail of the rods of the jaws. Scale bar=100 μm.

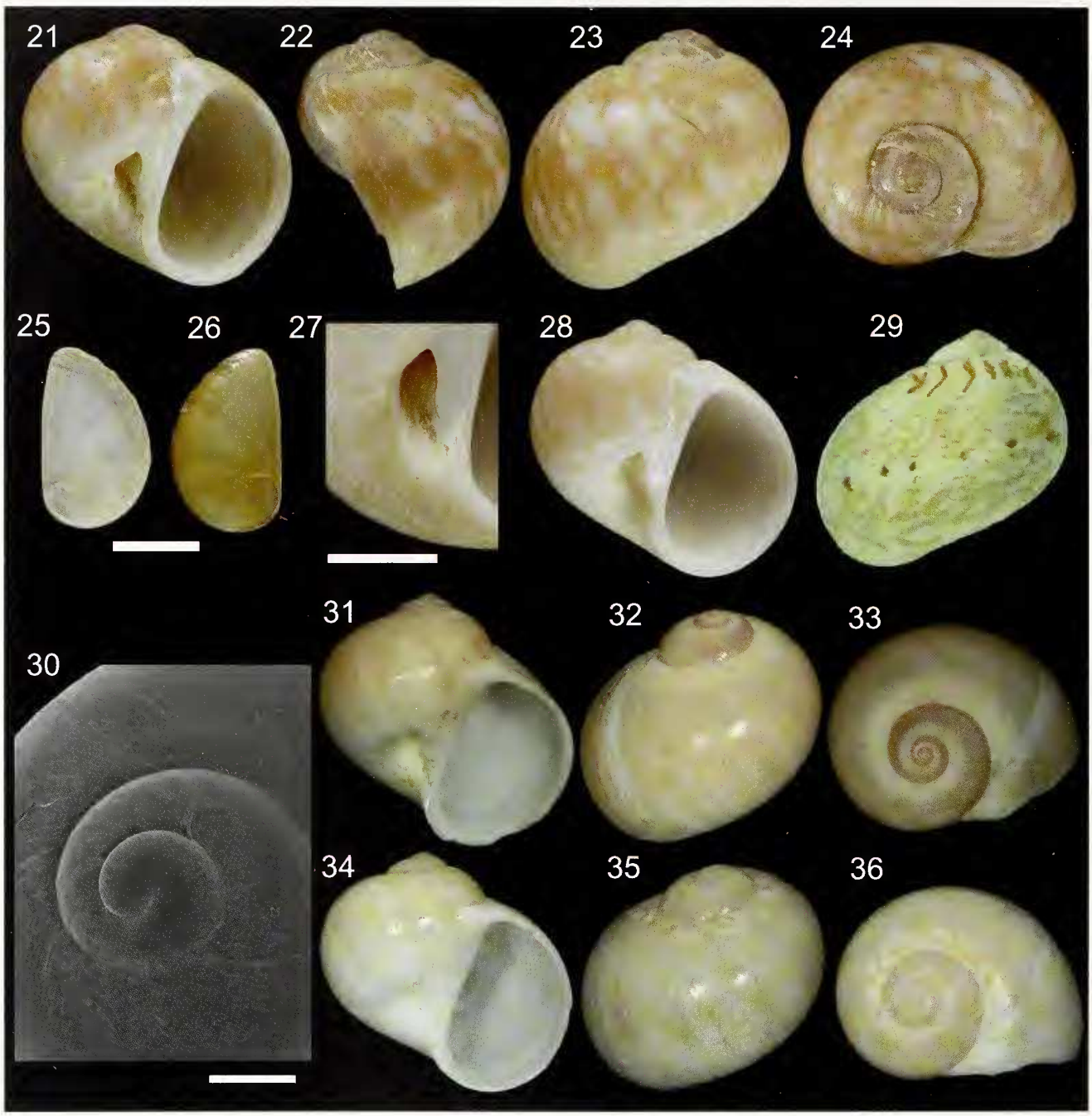
subsutural, spiral band always present. Opereulum with a smooth internal margin.

Description: Large shell (Figures 1–4, 7–8), holotype 33.2 mm in height (40.0 mm maximum height), globose, spire moderately elevated; shell thiekness average for genus; protoconch (Figure 8) of about 3.0 whorls (1.4 mm of diameter), smooth, without ornamentation, transition to teleoconch defined. Suture distinetly impressed. Teleoconch with up to three rounded whorls; axial sculpture of incised furrows on first teleoconch whorls, turning into oblique ineremental growth lines in sueeeeding whorls; suture adpressed. Parietal callus very thin, separated from umbilieal callus by notch; lobe of anterior parietal callus large, weakly defined. Umbilicus (Figure 7) moderately narrow, always open; umbilical callus moderate in size, always present; suleus deep, excavated, straight (ehannel wide, overtaking anterior internal lip without noteh); funiele moderately developed; basal lip sharp. Aperture very large, semicircular.

Color of fresh specimens brownish white, axial and oblique bands present from snture to lower third of whorl; white thin subsutural spiral band always present. Periostracum brownish, very thin.

Operculum ealeareous (Figures 5–6, 15), semicireular, solid, paueispiral, closing entire aperture. Internal opereular seulpture of growth lines, eovering whole surface; two well defined marginal ribs of angular profile, after them, a spiral groove along outer margin as wide as both marginal ribs together; caleified granulose zone on center of operculum; inner and outer margins smooth.

Radulae taenioglossate (2-1-R-1-2), rachidian teeth trapezoidal with three sharp eusps, eentral eusp larger than lateral cusps, anterior edge of base straight, posterior edge slightly convex centrally and concave at tips, ending in two sharp lateral processes. One lateral tooth

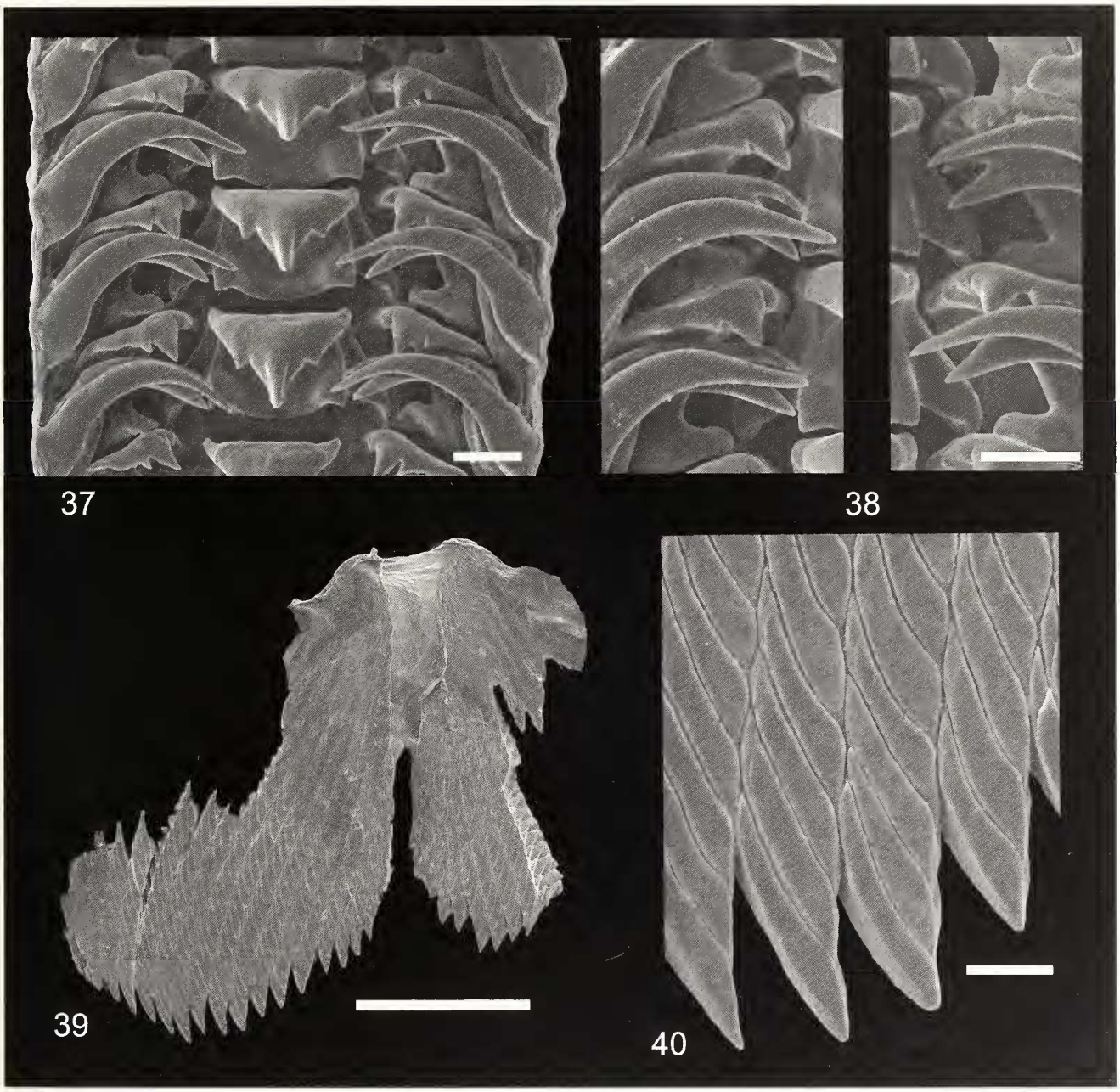


Figures 21–36. *Natica* species. **21–28, 30.** *Natica juani* new species. **21–27.** Holotype MNRJ 17876, 9.0 × 9.0 mm. **25–26.** External and internal views of the operculum scale bar = 2.5 mm. **27.** Detail of the umbilical area, scale bar = 5 mm. **28.** Paratype MNRJ 17877, 9.5 × 9.6 mm. **30.** *Natica juani* new species, Paratype MNRJ 17875, detail of the protoconch SEM picture, scale bar = 500 µm. **31–33.** *Natica perlineata*. Syntype USNM 87201, 18.0 × 18.2 mm. **34–36.** *Natica castrensis*. Syntype USNM 87198, 12.2 × 12.8 mm. **29.** *Natica menkeana*, original illustration (Philippi, 1851, pl. 15, fig. 8).

on each side, each with three cusps, central cusp four times larger than almost-obsolete lateral cusps, inner edge with two conspicuous basal prolongations. Two marginal teeth curved towards rachidian tooth; inner marginal tooth bifid with cusps of different sizes, inner cusp smaller (Figures 17–18).

Jaws trapezoidal; rods elongated, virgule shaped, diagonally arranged (Figures 19–20).

Type Material: Holotype MNRJ 11866, collected alive on 11/2005 by P. M. S. Costa and J. Coltro Jr.; Paratypes, MNRJ 11867, 12 shells and 3 opercula,



Figures 37–40. *Natica juani* new species. Holotype MNRJ 17876. **37.** Radula, frontal view, Scale bar = 20 µm. **38.** Two details of lateral teeth. Scale bar = 20 µm. **39.** Jaws. Scale bar = 200 µm. **40.** Detail of the rods of the jaws. Scale bar = 20 µm.

08/2005; MZSP 53715, 6 shells; MZSP 53926, 2 shells; MZSP 55525, 1 specimen; MZSP 70293, 7 shells; MZSP 71794, 4 shells; all paratypes from the type locality.

Type Locality: Canopus Bank, off Fortaleza, Ceará, Brazil, 02°14′25″ S, 38°22′50″ W, dredged between 240–260 m depth, from biogenic substratum, collected by P.M.S. Costa and J. Coltro Jr.

Distribution: Known from the type locality only (see map Figure 41).

Etymology: Dedicated to Laura Gomes Costa, daughter of the senior author.

Remarks: The new species has the diagnostic characters of the genus *Notocochlis*, an operculum with two

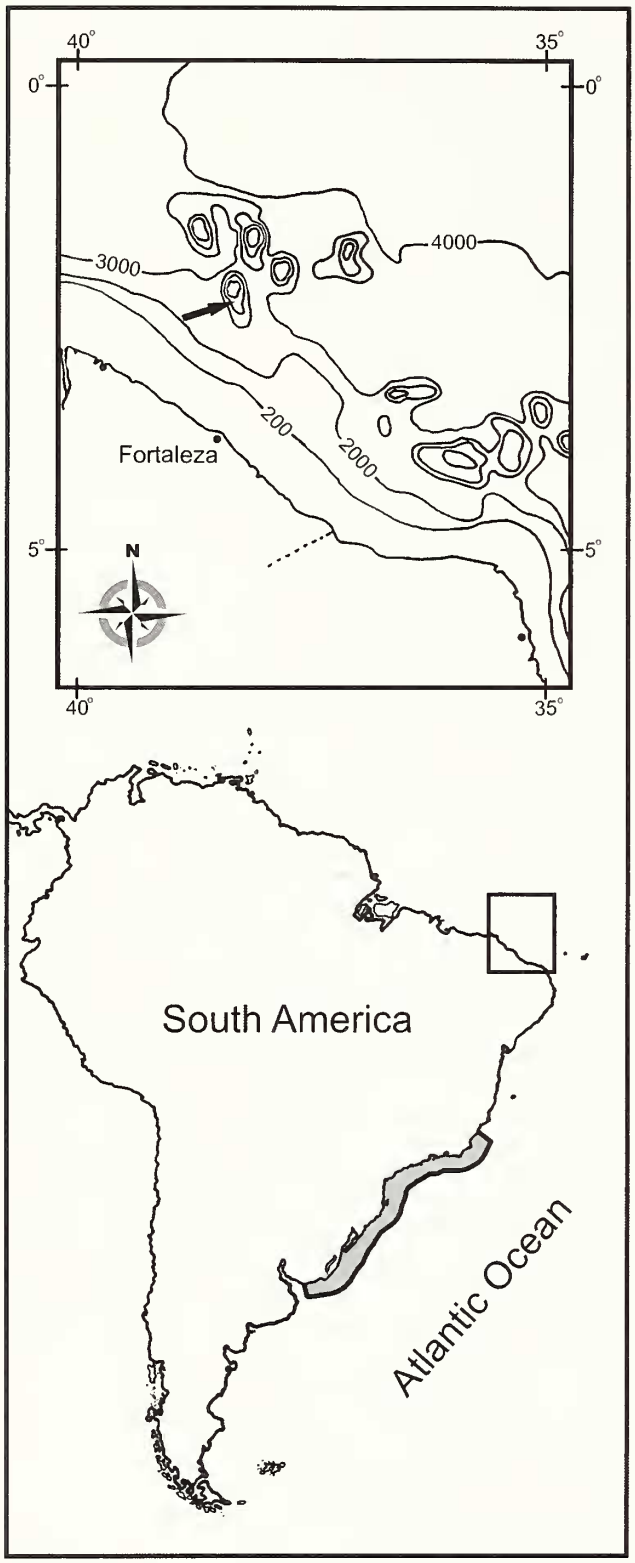


Figure 41. General map showing most of the localities mentioned in text. The gray area indicates the distribution of *N. juani* new species. On top, detail of Canopus Bank area, the black arrow indicates the type locality of *N. laurae* new species.

marginal ribs and smooth margins, as well as the fused umbilical and parietal calluses. *Notocochlis laurae* new species is comparable to *Notocochlis guesti* (Harasewych and Jensen, 1984) (Figures 9–11, 16), which occur from Bermuda to Colombia in moderate deep water (live 201 m). The two species differ, however, in shell shape, color pattern, and operculum sculpture. Individuals in the new species have a higher spire, with the color pattern consisting of an irregular brown band above milk white background without flammules. *Notocochlis guesti* shows one or two spiral bands of brown dots or flammules. The operculum of *N. laurae* new species has two marginal ribs of the same size with an angulated profile, a groove as wide as both marginal ribs together, and the inner margin not serrate. *Notocochlis guesti* has the second marginal rib three times wider than the first, forming a broad plateau and a groove slightly narrower than the second rib. In addition, the inner margin is strongly serrate.

The comparable South Atlantic species belonging to the same genus is *Notocochlis isabelleana* (d'Orbigny, 1840) (Figures 12–14). In addition to the different coloration, *N. laurae* new species is almost twice as large as *N. isabelleana*, which also has a quadrangular profile with a prominent shoulder and higher spire, while the new species is higher than wider, with a shallower suture and thicker basal lip. The opercula in the two species are also quite different, with the operculum in the new species having two well defined marginal ribs, while the operculum of *N. isabelleana* has only one. Finally, there is a significant geographical disjunction between both species, since *N. laurae* new species is a deep water species (~250 m) from off northeastern Brazil, while *N. isabelleana* is a common shallow water species (0–100 m) from the Argentine malacological province.

Genus *Natica* Scopoli, 1777

Type Species: *Natica vitellus* (Linnaeus, 1758) by subsequent designation (Anton, 1838).

Natica juani new species
(Figures 21–28, 30, 37–40)

Type Species: *Natica menkeana* auct.: Costa, Fortes and Freitas, 1997: 14; Costa, Rios and Calvo, 1997: 16 (non Philippi, 1851).

Diagnosis: Shell small, smooth. Umbilicus wide, open; umbilical callus weak fused with parietal callus; sulcus straight, well developed; funicle obsolete; basal lip thick. Color of white background with axial brownish zig-zag flammules, irregularly spaced and interconnected, covering whole shell. Calcareous operculum with a serrate internal margin, and two thick, sometimes one thinner, cords on external margin.

Description: Shell (Figures 21–24, 27–28, 30) small, thick-walled, up to 14 mm of maximum height, globose, spire short, with about two and half whorls; body whorl well developed; protoconch (Figure 30) of about 1.5 whorls

(950 μm of diameter), smooth, without ornamentation, transition to teleoconch well defined; Suture distinetly impressed. Axial sculpture of oblique incremental growth lines. Parietal eallus thin; lobe of anterior parietal callus weakly defined but large. Umbilicus (Figure 27) wide, always open; umbilical eallus moderate in size, fused with parietal callus, always present; sulcus deep, excavated, straight; funiele moderately developed; basal lip sharp. Aperture very large, semieireular.

Color (fresh specimens) white baekground with axial brownish zig-zag flammules, irregularly spaeed, intereonnected, forming a network, particularly on middle of last whorl. Some specimens with thin, dark periostracum.

Operculum (Figures 25–26) semicircular, solid, eompletely calcified, paucispiral, closing entire aperture. Internal opereular sculpture of growth lines covering whole surfaee; two well defined marginal ribs, sometimes one extra, thinner, after them, a spiral groove along outer margin; caleified granulose zone on eenter of opereulum; inner margin serrate, outer margin smooth.

Radulae taenioglossate (2-1-R-1-2), rachidian teeth trapezoidal with three eusps, eentral one larger, almost obsolete, lateral cusps smaller, anterior edge of base straight, posterior edge slightly convex eentrally and concave at tips, ending in two weak lateral processes. One lateral tooth on eaeh side; central eusp of lateral teeth twice as large as lateral cusps, inner edge of lateral teeth with conspieuous basal prolongation toward center. Two marginal teeth long, curved toward rachidian tooth; inner marginal tooth bifid with cusps of different sizes, inner eusp smaller (Figures 37–38).

Jaws pyriform; rods elongated, comma-shaped, diagonally arranged (Figures 39–40).

Type Locality: Southern littoral of São Paulo State, Brazil, in ~17–35 m.

Distribution: Rio de Janeiro, Brazil to Uruguay (Figure 41).

Type Material: Holotype, MNRJ 17876, southern littoral of São Paulo State, Brazil, in ~17–35 m, from the digestive tract of *Astropeeten* sp., shrimp net; Paratypes: MNRJ 15029, off Búzios, Rio de Janeiro State, Brazil, 22°42′39.4″ S , 40°40′50.2″ W, 3 shells collected on 03/2007; MNRJ 15030, off Búzios, Rio de Janeiro State, Brazil, 22°41′49″ S, 40°40′29.8″ W, 3 shells eolleeted on 03/2007; MNRJ 15028, off Ilha de Cabo Frio, Arraial do Cabo, Rio de Janeiro State, Brazil, 23°18′00″ S, 40°00′00″ W, fishing vessel Muriaé III coll., 2 speeimens colleeted on 04/1993; MNRJ 17875, between Rasa Is. and Ilha Grande, Rio de Janeiro State, Brazil, fishing vessel Marques Torres coll., 2 shells; collected on 02/1994, from the digestive tract of bat fish *Ogeoeephalus vespertilio* (Linnaeus, 1758); MNRJ 17877, from the type locality, 1 shell; MACN-In 39255, from the type locality, 10 speeimens; MZSP 32274, off Ilha Grande, Rio de Janeiro State, 1 speeimen, dredged on 07/11/1969; MZSP 31946, east of Ilha de Vitória, São Paulo State, 36–40 m, 24 specimens, eolleeted with shrimp net, on 06/1999; MZSP 32103, southeast of Lage de Santos, São Paulo State, 55–62 m, 2 shells, collected with shrimp net, on 10/1999; MZSP 32201, off Itajaí, Santa Catarina State, 26°37′ W, 48°15′ S, 85 specimens, collected by otter trawl, Carlo Magenta leg., 04/1997; MNHNM 15517 MARE, 35°38.2′ S, 53°43′ W to 35°39.4′ S, 53°44.7′ W, 61.5–63 m, 1 speeimen collected on 14/11/05; MNHNM 15520, MARE, 35°24.6′ S, 53°24′ W to 35°26′ S, 53°25.7′ W, 60–61 m, 1 shell collected on 1/10/07; MNHNM 15521, MARE, 35°58.1′ S, 53°52.3′ W to 35°59.4′ S, 53°53.5′ W, 62–63.5 m, 2 shells collected on 3/10/07.

Etymology: Dedicated to Juan Pastorino, son of the junior author.

Other Material Examined: MNHNM 10989, R/V Academik Knipovich, St. 1067, 22–29/4/1967, Okean Dredge, 34°26′ S, 51°48.7′ W, 166 m, (3 shells) collected by V. Scarabino; MNHNM 15514, 12/11/05, MARE, 34°41.7′ S, 52°35.6′ W to 34°43.1′ S, 52°37.0′ W, 66–68 m, (2 shells); MNHNM 15513, collected on 12/11/05, MARE, 34°46.5′ S-52°23.7′ W to 34°44.7′ S, 52°23.5′ W, 101–104.5 m, (1 shell); MNHNM 15515, 12/11/05, MARE, 34°55.8′ S, 52°39.5′ W to 34°57.5′ S, 52°40.0′ W, 80.5–82.5 m, (1 shell); MNHNM 15519, MARE, 34°58.2′ S, 52°30.9′ W to 34°59.4′ S, 52°32.0′ W, 108–106 m, 1 shell collected on 12/11/05; MNHNM 11233 R/V Academik Knipovich, St. 1061, 22–29/4/1967, Okean Dredge, 35°04.0′ S, 52°13.6′ W, 175 m, (2 shells), collected by V. Scarabino; MNHNM 15516 13/11/05, MARE, 35°22.9′ S, 53°18.0′ W to 35°24.5′ S, 53°19.3′ W, 62–63.5 m, (1 shell); MNHNM 15518, 14/11/05, MARE, 35°38.2′ S, 53°43′ W to 35°39.4′ S, 53°44.7′ W, 61.5–63 m, (1 shell); all material, except noted, collected by F. Scarabino on board B/I Aldebarán.

Remarks: The complex coloration pattern, fused umbilieal and parietal calluses, operculum calcareous with serrated internal margin, and up to three marginal ribs, are the features of the new species that allow the inclusion in the genus *Natiea*. The new species is eomparable to *Natica menkeana* Philippi, 1851, which is common in Puerto Rico and rare elsewhere in the West Indies. Aeeording to eomparative material examined, the specimen illustrated by Warmke and Abbott (1962: 96, pl. 17 fig. c), and the original illustration (Philippi, 1851b: pl. 15, fig. 8, reprodueed here in Figure 29), the coloration pattern is the main difference. While *N. menkeana* presents a network of reddish brown markings below the suture and a spiral band below the middle of the body whorl, the new speeies has a subsutural white field, and, after it, a brownish network of zig-zag lines. In addition, the spire is shorter and the funicle appears to be larger. *Natiea eastrensis* Dall, 1889 appears to be a synonym of *N. menkeana* (A. Kabat pers. eomm., 2011). A syntype is illustrated here in Figures 34–36. The subsutural coloration and a remnant of spiral band below the middle of the body whorl are similar to the original illustration of *N. menkeana* and the specimen illustrated by Warmke and Abbott (1962).

In that same publication, Dall (1889: 294) described *Natica perlineata* as a possible variety of *N. castrensis*. The type material is illustrated here in Figures 31–33. The coloration pattern clearly indicates that *N. perlineata* is not conspecific with *N. menkeana* or *N. jnani* new species.

ACKNOWLEDGMENTS

We want to thank to José Carlos Tarasconi, Porto Alegre, Brazil, for the loan of the specimens of *Natica jnani* and the usual support to our research. A special thanks to Antonio Gil Bezerra and Elisa Gradvohl Bezerra, owners of INACE Shipyard (Industria Naval do Ceará) for use of their fishing boat and to José and Marcus Coltro by financial support to the field trips to Canopus Bank in August and November 2005. Comments by Renata Gomes greatly improved an earlier draft of this paper. Fabrizio Scarabino (MNHNM) read an early draft of this paper and found several specimens in the old collection of the MNHNM that helped extend the distribution of *N. jnani*. Elivaldo de Lima from "Centro de Miscroscopia Eletrônica de Varredura", Museu Nacional/UFRJ (supported by CENPES/PETROBRAS), helped with SEM micrographs of protoconchs. The manuscript improved dramatically with the revision of Alan Kabat and an anonymous reviewer. Ellen Strong and Yolanda Villacampa (USNM) helped us with photographs from Dall's type material. Emilio García (Lafayette, LA) provided samples of rare specimens from his own collection. Conselho Nacional de Desenvolvimento Científico e Tecnológico, Brazil (CNPq) provided a PROTAX postdoctoral grant support No. 155263/2006-4 to P.M.S. Costa.

LITERATURE CITED

Anton, H.E. 1838. Verzeichnis der Conchylien. Halle, xvi + 110 pp.

Costa, P.M.S., E.C. Rios, and I.S. Calvo. 1997. Moluscos Encontrados no Trato Digestivo do Peixe-Morcego, *Ogcocephalus vespertilio* (Linnaeus, 1758) Coletados na Costa do Rio de Janeiro. Siratus, São Paulo 3(13): 16–19.

Costa, P.M.S., R.R. Fortes, and C.A. Freitas. 1997. Lista de Macromoluscos Coletados por Barcos de Pesca de Arrastão ao Largo da Costa do Estado do Rio de Janeiro, Sudeste do Brasil. Siratus, São Paulo 3(13): 14–15.

Dall, H. 1889. Reports on the results of dredgings, under the supervision of Alexander Agassiz, in the Gulf of Mexico (1877–78) and in the Caribbean Sea (1879–80), by the U. S. Coast Survey Steamer 'Blake'. Bulletin of the Museum of Comparative Zoology 18: 1–492, pls. 10–40.

Pastorino, G. 2005. Recent Naticidae (Mollusca: Gastropoda) from the Patagonian coast. The Veliger 47: 225–258.

Philippi, R.A. 1851a. Centuria quarta testaccorum novorum. Zeitschrift für Malakozoologie 8: 39–48.

Philippi, R.A. 1851b. Die Gattung *Natica* und *Amaura*. In: Systematisches Conchylien-Cabinet von Martini und Chemnitz, vol. 2, pls. A, 13–18.

Rios, E.C. 1994. Seashells of Brazil. 2nd. ed.. Fundação da Universidade do Rio Grande, Rio Grande. 368 pp.,113 pls.